FLEXIBLE CLUSTER RENDERING
WITH NVIDIA VCA

PHILLIP MILLER
ANKIT PATEL
AGENDA

- Physically based rendering
- Interactive cloud rendering

- Commercial solutions
  - Iray
  - V-Ray RT
  - OptiX
Physically Based Ray Tracing

- No longer “If it looks right, it is right” but a simulation of the world as you see and understand it
Physically Based Ray Tracing

- No longer “If it looks right, it is right” but a simulation of the world as you see and understand it

- A rendering system that consistently handles:
  - Lighting, Shading, Materials, Cameras, Tone Mapping, Environments
  - Energy Conserving and in Linear Color Space (“Unbiased”)

- NVIDIA’s PBRT History:
  - 2006: in Autodesk M&E products (mental ray)
  - 2009: in Catia and 3ds Max (Iray)
  - 2014: Technical Academy Award Nominee
    - Award won by two NVIDIA Veterans
The Traditional Realism/Complexity Ratio

Global Illumination
Realistic Lighting
Photon Mapping
Custom Shaders
Radiosity
Realistic Reflections
Shading

Complexity / Difficulty

Realism
PBR

Reversing the Realism/Complexity Ratio

Physically Based Path Tracing

- Global Illumination
- Realistic Lighting
- Photon Mapping
- Custom Shaders
- Radiosity
- Realistic Reflections
- Shading

Realism

Complexity / Difficulty
Physically Based Path Tracing

- Physically Based Lighting with Emissive Distribution Functions

- Physically Based Materials formed from BSDF Elements and Functions

Workflow

- Think in terms of the physical world; assign Lighting & Materials; add Iray
Physically Based Ray Tracing

- Physically Based Lighting with Emissive Distribution Functions
- Physically Based Materials formed from BSDF Elements and Functions

Workflow
PBRT Reversing the Realism/Complexity Ratio

Physically Based Ray Tracing

- Global Illumination
- Realistic Lighting
- Photon Mapping
- Custom Shaders
- Radiosity
- Realistic Reflections
- Shading

A Perfect Match for GPUs

Complexity / Difficulty

Computational Intensity

Realism

A Perfect Match for GPUs
GTC 2014 Keynote with Honda Japan
GTC 2014 Keynote

Interacting with Complete, Original Automotive Data
HDR Environment of Stage used for Image-Based Lighting
GTC 2014 Keynote

Resulting Augmented Reality Interacted with Minimal Noise from remote VCAs
CHALLENGES TO INTERACTIVE CLOUD RENDERING

Traditional Network Rendering

- Workstation
  - Distributed Rendering
  - Distributed Rendering
  - Distributed Rendering

- Workstation
  - Cloud node
  - Cloud node
  - Cloud node

Distributed Rendering
### QUADRO VCA

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GPUS / CUDA CORES</strong></td>
<td>8 / 24,576</td>
</tr>
<tr>
<td><strong>GPU MEMORY</strong></td>
<td>12 GB per GPU</td>
</tr>
<tr>
<td><strong>CPU CORES</strong></td>
<td>20 Physical</td>
</tr>
<tr>
<td><strong>SYSTEM MEMORY</strong></td>
<td>256 GB</td>
</tr>
<tr>
<td><strong>STORAGE</strong></td>
<td>2 TB SDD</td>
</tr>
<tr>
<td><strong>NETWORK</strong></td>
<td>2 x 1GigE, 2 x 10GigE (SFP+), 1 x InfiniBand</td>
</tr>
<tr>
<td><strong>INSTALLED SOFTWARE</strong></td>
<td>Linux Cent OS 6.6, Iray 2015, OptiX, V-Ray RT, VCA Manager</td>
</tr>
<tr>
<td><strong>US MSRP</strong></td>
<td>$50,000</td>
</tr>
</tbody>
</table>
DEMO CLUSTER

Mellanox SX6036

InfiniBand Interconnect
1U - Mellanox SX6036
36 port - FDR (56Gb/s)
Non-blocking Managed

Rack configuration is site dependent due to space, power, & cooling
VCA DEMO CLUSTER

Cisco x3560 48 port switch

InfiniBand

1 GigE Company Network

Ethernet

Cloud

Remote Clients
NVIDIA QUADRO VCA

- Fastest GPU rendering on a single node
- Scale beyond a desktop workstation
- High quality, interactive rendering
- Centralize and Share GPU rendering resources
“NVIDIA VCA unleashed the power of Iray -- bringing to life our designs. It was a stunning visual experience for all of us.”

Guillaume Shan
Renault Design Digital Visualization
“For the 4K stereo render of CONSTRUCT, a frame that took 9.5 hours to render on a multi-core workstation using V-Ray took 14 minutes on a single VCA, and it was interactive on a cluster of 15 VCAs. Amazing.”

Kevin Margo
Director

VISUAL EFFECTS
“Using NVIDIA VCA in our daily workflow allows us to work interactively with clients at a very high level of realism. Though we’ve only just begun to scratch the surface, its potential is mind-blowing.”

Roland Gauthier
HINGE Digital
COMMERCIAL SOLUTIONS

- Iray
- V-Ray RT
- OptiX
- 3rd Party applications
IRAY® PHOTOREAL
Realism Made Easy

- Physically-based rendering with a strong parallel to photography
- You know what to expect and adjust, we know what to program - it all just works
IRAY 2015

- Physically-Based Renderer - calculates how light and materials interact
- New: Material Definition Language - makes materials interchangeable and provides consistent results across applications
- Built for NVIDIA Quadro and Quadro VCA
- Together with Quadro enables interactive PBR, scalable from laptops to data centers
MORE THAN 2X THE PERFORMANCE

- Iray 2015 and Quadro Maxwell 2.4x faster than Iray 2014 and Quadro Kepler
- BMW Z4 Rendered using Iray at 2,000 iterations at 4K
Within Commercial Products

- **Catia Live Rendering**
- **SOLIDWORKS Industrial Designer**
- **Bunkspeed**
- **Shot & Zoom**

- **3ds Max (mental ray)**

- **SIEMENS PLM**
  - shipping by year’s end

- **migenius**

- **DAZ Studio**
- **SketchUp (Bloom Unit)**
Coming this year from NVIDIA

- Iray+ for 3ds Max
- Iray for Maya
- BIM IQ Render - Iray for Revit
- Iray for Cinema 4D
- Iray for Rhino
- Iray Server
V-Ray RT for Interactive Rendering

- Architects
- Product Designers
- 3D Animators
- VFX Artists and Post Houses
V-RAY RT FOR FINAL FRAME RENDERING

V-Ray RT 3.0 New Features

- Render Elements, allowing layers of final frames to be individually rendered for assembly in compositing application
- 10-20X performance acceleration over CPU-based V-Ray
V-Ray RT Solutions

V-Ray RT for 3ds Max

V-Ray RT for Maya

V-Ray RT for Motion Builder
OPTIX 3.8 BETA
AVAILABLE THIS WEEK

- Progressive API
  - Single call to accumulate iterations/sub-frames into final frames

- Quadro VCA Support
  - Minimal effort to obtain client-server rendering when using the new Progressive API

- Future “VCA on Demand”
  - Look for a Prototype Service coming from NVIDIA later this year
Third party Linux applications can be installed

- NVIDIA provides access to Quadro VCAs for remote testing & certification
- Application registers with the VCA Manager
- Scaling, distribution, and client/server capabilities are (of course) up to the respective application solution
THANK YOU

JOIN THE CONVERSATION
#GTC15